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Acceptance and Discomfort from Atraumatic Restorative Treatment in Secondary School Students in Egypt

A. Farag[a] J.E. Frencken[b]

[a]Department of Operative Dentistry, Faculty of Oral and Dental Medicine, Minia University, Minia City, Egypt;
[b]WHO Collaborating Centre for Oral Health Care Planning and Future Scenarios, Radboud University Nijmegen Medical Centre, College of Dental Sciences, Nijmegen, The Netherlands

Key Words
Atraumatic restorative treatment · Discomfort · Cavity size · Dental anxiety · Pain · Egypt

Abstract
Objectives: To assess the level of acceptance and discomfort experienced by secondary school students when undergoing an atraumatic restorative treatment (ART) restoration. ***Subjects and Methods:*** Ninety secondary school students, aged 14 and 15 years, were included in the study. The ART restorations were prepared in 90 cavities and restored using an encapsulated high-viscosity glass ionomer. The depth of the cavities was judged from radiographs and clinically into outer, middle and inner third of dentine. Using a graded periodontal probe, cavity size was measured, into approximately half the width of the mesiodistal and buccolingual/palatal distance of the occlusal surface. The students were asked about the level of sensation experienced during cavity preparation immediately after completion of restoration. χ^2-Test was used to test the effect of cavity depth and size on sensitivity from the teeth. ***Results:*** Of the 90 students, 6 (6.6%) and 26 (29.2%) experienced pain and discomfort, respectively, during cavity preparation, more often in large than in small cavities ($p = 0.003$) and in cavities extending into the inner third than in the middle and outer third of dentine ($p < 0.0001$). Only 1 student reported postoperative sensitivity. ***Conclusions:*** The ART approach to treat dental cavities was well accepted by this group of secondary school students. Only a few reported pain during cavity instrumentation, and this was more prevalent in large cavities and in cavities with the floor close to the pulp.

Introduction

Although no epidemiological studies of dental caries have recently been carried out in Egypt, annual reports suggest that the prevalence and severity of dental caries amongst the younger population is high [1]. Because oral health services are predominantly provided in urban areas, the rural populations face a shortage of basic services, including caries prevention and restoration of cavitated teeth. Dentists prefer to work in urban environments and those employed in rural areas often find that maintenance of the basic equipment required to perform traditional restorative care is lacking. This in turn reduces the possibility of providing restorative care in rural areas. Therefore, a different approach needs to be adopted if rural communities are not to be permanently excluded from the type of care available to urban communities.

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Dr. J.E. Frencken
WHO Collaborating Centre for Oral Health Care Planning and Future Scenarios
Radboud University Nijmegen Medical Centre, College of Dental Sciences
PO Box 9101, NL–6500 HB Nijmegen (The Netherlands)
Tel. +31 24 361 4050, Fax +31 24 354 0265, E-Mail j.frencken@dent.umcn.nl

Health authorities have, therefore, shown interest in an investigation of the appropriateness and acceptance of atraumatic restorative treatment (ART) in Egypt. No electricity or plumbed water supply is needed when ART is applied, as only hand instruments are used to remove carious tissues and apply adhesive dental materials to fill cleaned cavities and adjacent pits and fissures [2]. Although ART has been studied in a number of countries in different continents and has yielded qualitatively good results [3–6], the quality of ART restorations over time under the high cariogenic challenge found in Egyptian child populations has been questioned by a number of dentists in Egypt. Their worries, in particular, concerned the inability to remove infected dentine completely when using ART, and this was thought to predispose to development of secondary caries. This concern within the country's profession needed to be addressed, as these perceptions could inhibit the introduction of the ART approach on a wider scale. Potential barriers to introducing new techniques in (oral) health care need to be addressed early if the introduction is to have a chance of success [7].

One of the advantages of ART, compared to the traditional restorative approach using rotary instrumentation, is the significantly lower level of dental anxiety reported in both children [8, 9] and adults [10]. However, the level of sensitivity experienced during cavity preparation using ART, by size and depth of the cavity, has not been reported. This article reports on the level of acceptance and discomfort experienced by secondary school students when undergoing an ART restoration.

Subjects and Methods

Sampling Procedure

The ethics committee, comprising representatives of Minia University, Minia Local Government, Ministry of Education, Government Health Insurance and students' parents from Minia City in North Egypt, approved of the study. All form I students from 4 local government-allocated secondary schools constituted the study population. Students were examined clinically for dental caries status by the first author (A.F.), using the criteria developed by WHO [11]. The first set of inclusion criteria comprised the presence of cavitated dentine lesions with openings wide enough for the smallest excavator to enter but without (suspected) pulp involvement. Students having teeth with pulp involvement and those suffering from pain that could not be treated with ART (e.g. from periodontal problems) were referred to a dentist. The second set of inclusion criteria were informed consent, absence of medical complications, history of active bruxism or teeth clenching and xerostomia.

Implementation

ART treatment was performed by the first author (A.F.) in the well-equipped clinic of the Dental School of Minia University, from November 2001 to March 2002. The operator did not have any prior experience in placing ART restorations and had acquired its principles and directions from reading the literature. In order to simulate a field setting, only the dental chair, spittoon and operating light were used. No chairside assistant was available. A junior staff member assisted in the administration of the study. Before the treatment started, all students were individually instructed by the junior staff member about how best to clean their teeth.

Treatment Procedure

Isolation was achieved using cotton wool rolls, and cotton wool pellets were used to wet and dry the cavities. The ART approach consisted of removing plaque from the tooth surface with a probe and cotton wool pellets, and then opening the cavity with dental hatchets, removing soft carious tooth tissues with small and large excavators and filling the cavity and the adjacent pits and fissures with an encapsulated glass ionomer (Fuji IX® GP Fast; GC, Japan). The capsules were mixed for 10 s at 4,000 rpm in an amalgamator (Silamat; Vivadent, Liechtenstein) and placed in the capsule applicator (Capsule applier II; GC). Conditioning of the cavity and adjacent pits and fissures (Cavity conditioner; GC) preceded the placement of the glass ionomer for half of the restorations. In the other half, cavities were first disinfected for 1 min with a 2% chlorhexidine solution (Consepsis; Ultradent, USA) before being conditioned. The filled cavity and adjacent pits and fissures were kept under pressure of a gloved finger, rubbed with a thin coat of petroleum jelly for 30 s and coated with resin varnish (Fuji varnish; GC). Excess material was removed after bite check with articulating paper, using a sharp carver instrument (Ash, England). The final restoration was coated with a layer of resin varnish (Fuji varnish; GC). Multiple-surface cavities were filled after placement of a metal matrix band and holder (Tofflemire retainer; USA) and wedges. Local anesthesia was administered only once, to a student who insisted on being anesthetized before the treatment started.

Evaluation

Immediately after the treatment session was completed, the operator questioned students as to whether or not they had experienced sensitivity (discomfort or pain) during cavity manipulation. They were also asked whether they had accepted the received treatment now and if they would choose it in the future. The size of cavity opening after completion of cavity cleaning was measured with a graded periodontal probe and rated as being smaller or larger than half the width of the surface in both mesial-distal and buccal-lingual/palatal directions. After completion of the restoration, a bitewing radiograph was taken. One film was developed immediately and the other was stored in a refrigerator. The radiographs were used to assess depth of cavity in the outer 1/3, middle third or inner third of the dentine. The operator also judged the depth of the cavity in the deepest part using a graded periodontal probe. As each grade is 1 mm and as the distance from the dentoenamel junction to the pulp chamber at the occlusal surface is on average 3 mm, outer, middle and inner third of the dentine could be measured by placing the periodontal against the cavity wall. As radiographic images are two-dimensional and,

Table 1. Distribution of ART restorations by type of jaw, tooth type and type and size of cavity

		n	%
Type of jaw			
Maxilla		22	24.4
Mandible		68	75.6
Type of tooth			
Premolar		6	6.6
Molar		84	93.4
Type and size of cavity			
Class I	small	39	43.3
	large	31	34.5
Class II	small	8	8.9
	large	10	11.1
Cass IV	small	2	2.2

n = Number of restorations.

Table 2. Distribution of students according to level of acceptance, by gender

Level of acceptance	Male		Female		Total	
	n	%	n	%	n	%
Accepted	51	56.7	25	27.8	76	84.4
Accepted very much	6	6.6	8	8.9	14	15.6
Total	57	63.3	33	36.7	90	100

n = Number of restorations.

therefore, do not always project the actual depth clearly, particularly in small deep extensions, the final score for cavity depth was a combination of the radiographic image and the clinical assessment.

Statistical Analysis

The data were entered into an Excel (Microsoft, USA) data sheet and analyzed by a statistician of the University of Cairo, using SAS software (SAS Institute, Cary, N.C., USA). The χ^2-test was used to compare proportions. Statistical significance was set at $p < 0.05$.

Results

Disposition of Subjects

A total of 90 students, 57 males and 33 females aged 14 and 15 years, met the inclusion criteria. The distribution of ART restorations by type of jaw, tooth type and type of cavity is presented in table 1.

Acceptance of the ART Restorations

The percent distribution of level of acceptance according to gender is presented in table 2. All the students found the ART restorative treatment that they had received acceptable and all expressed their desire to be treated with ART again, if necessary, in the future.

Sensitivity Experienced with ART

Painful sensations during cavity preparation using ART were experienced by 4 (4.5%) males and 2 (2.2%) females, whilst 12 (13.5%) males and 14 (15.7%) females experienced some discomfort. The percent distribution of level of sensitivity experienced during ART cavity preparation, by type and size of cavity, is shown in table 3. Within each group, pain and discomfort were experienced more often in large than in small cavities ($p = 0.003$). The percent distribution of level of sensitivity experienced during ART cavity preparation is presented in table 4 according to depth of cavity. Within each subgroup, pain and discomfort were experienced more often in cavities that extended into the inner third of the dentine than in the middle and outer thirds of dentine ($p < 0.0001$).

Only 1 student reported postoperative sensitivity, which had disappeared by the 3-month evaluation period.

Discussion

Previous studies have shown the ART approach using hand instruments to be less painful than the traditional approach using rotary instruments [8–10, 12] when managing dental cavities. Therefore, using a control group to study the level of sensitivity during ART cavity instrumentation, by size and depth, was considered unnecessary. Instead, a straightforward cross-sectional investigation was done to provide the required additional information about the applicability and level of sensitivity and acceptance of ART in an adolescent population in Egypt.

The level of pain reported by these students was low (6.6%) and appears to be lower than the level of pain (19.3%) reported by age mates from Pakistan [8]. This finding was obtained despite the fact that the operator in the present study had had no prior experience in using ART when the study commenced. However, reporting ART after the treatment has been completed is a subjec-

Table 3. Distribution according to level of sensitivity experienced during ART cavity preparation by type and size of cavity

Sensitivity	Class I small		Class I large		Class II small		Class II large		Class IV small		Total	
	n	%	n	%	n	%	n	%	n	%	n	%
No pain	30	33.3	15	16.7	6	6.1	4	4.4	2	2.2	57	63.3
Discomfort	8	8.9	11	12.2	2	2.2	5	5.5	0	0	26	28.9
Pain	1	1.1	5	5.6	0	0	0	0	0	0	6	6.7
No report	0	0	0	0	0	0	1	1.1	0	0	1	1.1
Total	39	43.2	31	34.4	8	8.9	10	11.1	2	2.3	90	100

n = Number of restorations.

Table 4. Percent distribution of level of sensitivity experienced during ART cavity preparation, by depth of cavity

Sensitivity	Outer third dentine		Middle third dentine		Inner third dentine		Total	
	n	%	n	%	n	%	n	%
No pain	21	23.3	23	25.6	13	14.4	57	63.3
Discomfort	2	2.2	7	7.8	17	18.9	26	28.9
Pain	0	0	1	1.1	5	5.6	6	6.7
No report	0	0	0	0	1	1.1	1	1.1
Total	23	25.6	31	34.4	36	40.0	90	100

n = Number of restorations.

tive form of assessment, which is culturally determined. It is known that children from different cultures have different strategies for coping with distress [13]. Nevertheless, in line with other studies, the present study showed that the use of ART caused low levels of pain and discomfort in adolescents. A spin-off from the use of ART was that there was no need to resort to administration of local anesthesia. This result is similar to that reported by Van Bochove and van Amerongen [14], who demonstrated that young children with a mean age of 7 years preferred ART, using hand instruments without local anesthesia as the treatment for dental cavities, to the traditional approach using local anesthesia and to ART and local anesthesia. These findings indicate that children prefer hand instruments to rotary instruments and that ART without anesthesia is preferred to ART with local anesthesia. It is generally accepted that children do not like to be injected with local anesthetics and have their teeth drilled [15]. These two procedures are what many children mainly dislike about the traditional restorative methods of treating dental cavities.

Observations that larger-sized cavities and cavities with the floor close to the pulp cause significantly more pain and discomfort than smaller cavities and those with a base higher up in the dentine are not unusual.

All students treated accepted the ART approach when receiving a restoration for the first time. This, and the finding that only 1 student reported postoperative sensitivity, is in agreement with results reported on ART in similarly aged children by many researchers from different countries [16–21]. The degree of acceptance of treatment and the level of sensitivity of restorative care observed in these students indicates that the dental profession in Egypt would have sufficient reason to embrace the ART approach and further its investigation. In doing this they would follow dental professionals in many countries, including those in the USA [22], UK [23] and the Netherlands [24].

Conclusion

The ART approach to treating dental cavities was well received by this group of secondary school students. Only a few reported pain during cavity instrumentation, which was more prevalent in large cavities and in cavities extending close to the pulp.

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